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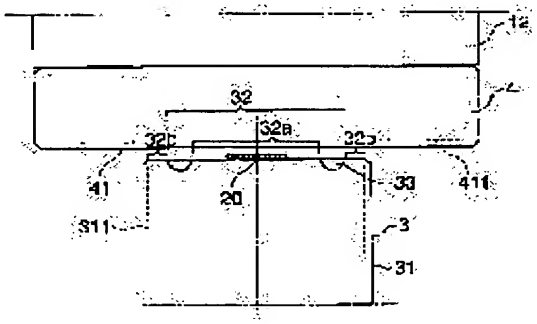
(54) METHOD OF MANUFACTURING SHAFT PORTION OF DYNAMIC PRESSURE BEARING MOTOR

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a method of manufacturing a shaft portion of a dynamic pressure bearing motor by jointing a shaft constituting a dynamic pressure bearing to a plate, with high precision, using a simple method.
SOLUTION: A circular recessed groove 33 is provided in a joint surface 32 of the shaft 3 and a mixture 20 formed with small metal balls 21 mixed into a past 22 is applied to an inner-periphery side joint surface 32a. The joint surfaces 32, 41 of the shaft 3 and the thrust plate 4 are opposed to each other, and a pulse current is carried between electrodes 12, 13, while energizing pressure on the joint surfaces 32, 41, to cause the melting of the small metal balls 21 and an area contacting the small metal balls 21 to make a melt diffused to the outer periphery side flow into the circular recessed groove 33. Before the melt solidifies, an outer-periphery-side joint surface 32b of the shaft 3 is made to abut against a joint surface 42 of the thrust plate 34.



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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The center of the one direction of this of the plate of the metal by which thrust dynamic pressure bearing is formed in the outer-diameter side of a field on the other hand which has a flat-tapped configuration, In the approach of joining the end face by the side of the end of the metal shaft in which radial dynamic pressure bearing is formed by the resistance welding method to the peripheral face which has the shape of a cylindrical shape, and manufacturing the shaft section of a hydrodynamic bearing motor The bore side of the annular melt receptacle slot of said plate formed in one field among the field and the end face of a shaft on the other hand, Or 1 or two or more corpuscles which consist of metal material are located in the part corresponding to said bore side in the field of another side. Energizing a necessary pressure to a plane of composition on both sides of this corpuscle, between said plates and shafts, pass a current and said corpuscle is fused. The manufacture approach of the shaft section of the hydrodynamic bearing motor characterized by the thing of said plate it was made for a field and the end face of said shaft to contact by the outer-diameter side of said melt receptacle slot on the other hand.
[Claim 2] Said corpuscle is the manufacture approach of the shaft section of the hydrodynamic bearing motor according to claim 1 characterized by being spherical grain.
[Claim 3] Said corpuscle is the manufacture approach of the shaft section of the hydrodynamic bearing motor according to claim 1 or 2 characterized by mixing the flow paste which has insulation and applying this mixture to the part corresponding to said bore side in the field of the bore side of said melt receptacle slot, or another side.
[Claim 4] The manufacture approach of the shaft section of the hydrodynamic bearing motor according to claim 1 characterized by preparing the crevice which carries out location immobilization of said corpuscle where a part is projected from the field of a member where this melt receptacle slot was formed in the bore side of said melt receptacle slot.
[Claim 5] Said corpuscle is the manufacture approach of the shaft section of the hydrodynamic bearing motor according to claim 1 to 4 characterized by consisting of the same quality of the material as either said plate or said shaft at least.
[Claim 6] The end face by the side of the end of the metal shaft by which radial dynamic pressure bearing is formed in the peripheral face which has the shape of a cylindrical shape, In the approach of joining by the resistance welding method in the condition of having made this center section of the metal plate with which thrust dynamic pressure bearing is formed in the outer-diameter side of the circular sulcus formed in the center section of the field by having the outer-diameter dimension of a major diameter from said shaft on the other hand contacting, and manufacturing the shaft section of a hydrodynamic bearing motor Are the end face of said shaft and it is formed in the circumference of a shaft. And, energizing the necessary pressure of the central field section including this crevice of the crevice for melt receptacles which has a major diameter from the bore of the circular sulcus of said plate, and said plate to a contact side with the center section of the field on the other hand, between said plates and said shafts, pass a current and the ingredient of said contact side is fused. The manufacture approach of the shaft section of the hydrodynamic bearing motor characterized by making it the circular sulcus of a

plate and the end face of a shaft contact by the outer-diameter side of said crevice for melt receptacles.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the approach of joining the plate of the metal in which thrust dynamic pressure bearing is formed, and the metal shaft in which radial dynamic pressure bearing is formed by the resistance welding method, and manufacturing the shaft section of a hydrodynamic bearing motor.
[0002]
[Description of the Prior Art] The hydrodynamic bearing motor is equipped with the hydrodynamic bearing in order to support body of revolution, enabling free rotation. The thing which a hydrodynamic bearing consists of for example, radial dynamic pressure bearing and thrust dynamic pressure bearing, and constitutes the shaft section from a cylinder-like shaft and a plate prepared at right angles to this, constitutes radial dynamic pressure bearing in the peripheral face of a shaft, and comes to constitute thrust dynamic pressure bearing at the flat surface of a plate, respectively is known. Although, as for the junction approach of a shaft and a plate, press fit, screwing, laser welding, resistance welding (or electric welding), etc. are known, especially resistance welding attracts attention from the ability of the squareness of the shaft after junction, and a plate to be made highly precise.
[0003] As what performs the above-mentioned resistance welding, to JP,2001-41246,A In the junction approach of of the shaft or flange (equivalent to a plate) which constitutes the hydrodynamic bearing of a hydrodynamic bearing motor The shaft whose end side used as a plane of composition is a convex curved surface is inserted in the cylinder space of a fixture sleeve, the base, and the shaft assembly fixture formed by spring material. It lays in the upper limit side of a fixture sleeve where the end side used as a plane of composition carries out movable [of the flange which is a flat surface] in the thrust direction through spring material to the base, a flange is pressed in the thrust direction by La Stampa, and the junction approach energized and welded where both planes of composition are contacted is indicated.
[0004]
[Problem(s) to be Solved by the Invention] However, the junction approach of JP,2001-41246,A is the structure which inserts a shaft in the cylinder space of a shaft assembly fixture, and since the bore of the fixture sleeve is set up a little more greatly than the outer diameter of a shaft, a minute gap is formed among both. When a shaft is installed in a shaft assembly fixture, a flange is laid in the upper limit side of a fixture sleeve by this and it pressurizes in La Stampa, a shaft has a possibility of being in the condition of contacting a flange, concentrating by the minute gap. And since a shaft assembly fixture is structure in which a fixture sleeve carries out movable to the base, it is difficult a fixture to carry out movable with high precision so that a fixture sleeve may not be concentrated to the base, and it is difficult for it to make a shaft contact keeping a flange level for this reason.
[0005] Therefore, even if it joins a shaft and a flange to JP,2001-41246,A using the shaft assembly fixture of a publication, it is difficult to make the squareness of a shaft and a flange highly precise (for parallelism of the convex curved surface of a shaft and the flat surface of a flange used as a plane of composition to be made highly precise, and to let it contact, if it puts in

another way).
[0006] This invention was made in view of the above, and aims at offering the approach of joining the shaft and plate which constitute a hydrodynamic bearing with high precision by the easy approach, and manufacturing the shaft section of a hydrodynamic bearing motor.
[0007]
[Means for Solving the Problem] The center of the one direction of this of the plate of the metal by which thrust dynamic pressure bearing is formed in the outer-diameter side of a field on the other hand with which this invention has a flat-tapped configuration, In the approach of joining the end face by the side of the end of the metal shaft in which radial dynamic pressure bearing is formed by the resistance welding method to the peripheral face which has the shape of a cylindrical shape, and manufacturing the shaft section of a hydrodynamic bearing motor The bore side of the annular melt receptacle slot of said plate formed in one field among the field and the end face of a shaft on the other hand, Or 1 or two or more corpuscles which consist of metal material are located in the part corresponding to said bore side in the field of another side. Energizing a necessary pressure to a plane of composition on both sides of this corpuscle, between said plates and shafts, a current is passed, said corpuscle is fused and it is characterized by the thing of said plate it was made for a field and the end face of said shaft to contact by the outer-diameter side of said melt receptacle slot on the other hand (claim 1).
[0008] According to this invention, the bore side of the annular melt receptacle slot on the plate formed in one field among the field and the end face of a shaft on the other hand, Or 1 or two or more corpuscles which consist of metal material are located in the part corresponding to said bore side in the field of another side. Since a current is passed and it was made to fuse said corpuscle between said plates and shafts, energizing a necessary pressure to a plane of composition on both sides of this corpuscle, only by letting said corpuscle and this part that contacts snugly pass at the time of energization, when a current flows, this part fuses. Moreover, while diffusing melt in an outer-diameter side as melting advances, a plate and the shaft of each other can be drawn near by the metallic bond, and a shaft and a plate contact the outer-diameter side of a melt receptacle slot. And if energization is ended and a fusion part solidifies, a shaft and a plate will join.
[0009] Since especially this invention does not form a lobe which serves as a failure in order to intervene, to join a corpuscle between each plane of composition of a shaft and a plate and to perform highly precise processing to the plane of composition before junction, there is no difficulty of processing for dynamic pressure slot formation or the grinding process for the improvement in flatness of a plane of composition, and a plane of composition can be finished very with high precision. Moreover, by existence of said melt receptacle slot, since the outer-diameter side of the melt fang furrow by the side of the bore of a slot is not reached, each plane of composition by the side of the outer diameter of a slot will contact, without melt intervening. The squareness of a plate and a shaft is secured from this with high degree of accuracy. Since the squareness of a plate and a shaft does not originate in the plane of composition of both members and a special fixture is not used at this time, a dimensional control can be simplified.
[0010] In that case, a granular solid sphere, then (claim 2) the current density which flows a contact part become high about said corpuscle, and melting becomes efficient.
[0011] Moreover, said corpuscle is mixed to the flow paste which has insulation, and before melting, on the end face of a shaft, a corpuscle is stabilized and is held by what (claim 3) this mixture is applied to the part corresponding to said bore side in the field of the bore side of said melt receptacle slot, or another side for.
[0012] Moreover, from the field of a member where this melt receptacle slot was formed in the bore side of said melt receptacle slot, where a part is projected, before melting, on the end face of a shaft, a corpuscle is stabilized and is held by what the crevice which carries out location immobilization of said corpuscle is prepared for (claim 4).
[0013] Moreover, the junction force increases because melting advances more efficiently and each part material fuses said corpuscle by what is made at least the same quality of the material as either said plate or said shaft (claim 5).
[0014] The end face by the side of the end of the metal shaft by which radial dynamic pressure

bearing is formed in the peripheral face in which this invention has the shape of a cylindrical shape, In the approach of joining by the resistance welding method in the condition of having made this center section of the metal plate with which thrust dynamic pressure bearing is formed in the outer-diameter side of the circular sulcus formed in the center section of the field by having the outer-diameter dimension of a major diameter from said shaft on the other hand contacting, and manufacturing the shaft section of a hydrodynamic bearing motor Are the end face of said shaft and it is formed in the circumference of a shaft. And, energizing the necessary pressure of the central field section including this crevice of the crevice for melt receptacles which has a major diameter from the bore of the circular sulcus of said plate, and said plate to a contact side with the center section of the field on the other hand, between said plates and said shafts, pass a current and the ingredient of said contact side is fused. It is characterized by making it the circular sulcus of a plate and the end face of a shaft contact by the outer-diameter side of said crevice for melt receptacles (claim 6).

[0015] According to this invention, the crevice for melt receptacles which has a major diameter from the bore of the circular sulcus of a plate is formed in the end face of a shaft at the circumference of a shaft. Since a current is passed and it was made to fuse the ingredient of said plane of composition between a plate and a shaft, energizing the necessary pressure of the central field section including this crevice, and a plate to a contact side with the center section of the field on the other hand, only by letting the above-mentioned contact side pass at the time of energization, when a current flows, this part fuses. Moreover, while diffusing melt in an outer-diameter side as melting advances, a plate and the shaft of each other can be drawn near by the metallic bond, and a shaft and a plate contact the outer-diameter side of a melt receptacle slot. And if energization is ended and a fusion part solidifies, a shaft and a plate will join.

[0016] In that case, especially this invention forms the central field section which includes this crevice of the crevice for melt receptacles which has a major diameter from the bore of the circular sulcus of a plate in the end face of a shaft. In order not to form a lobe which serves as a failure in order [of this central field section and a plate] to join the center section of the field on the other hand and to perform highly precise processing to the plane of composition before junction, There is no difficulty of processing for dynamic pressure slot formation or the grinding process for the improvement in flatness of a plane of composition, and a plane of composition can be finished very with high precision. Moreover, by existence of said crevice for melt receptacles, since the melt by the side of the bore of a crevice does not reach the outer-diameter side of a crevice, each plane of composition by the side of the outer diameter of a crevice will contact, without melt intervening. The squareness of a plate and a shaft is secured from this with high degree of accuracy. Since the squareness of a plate and a shaft does not originate in the plane of composition of both members and a special fixture is not used at this time, a dimensional control can be simplified.

[0017]

[Embodiment of the Invention] Drawing 1 is the whole motor sectional view for a magnetic-disk drive as an example of a hydrodynamic bearing motor.

[0018] As shown in drawing 1 , the hydrodynamic bearing motor 1 comes to have the hydrodynamic bearings HB1 and HB2 to which a lubricating oil comes to intervene between the Rota magnet 6 as a magnetic driving means and stator 7 which carry out the rotation drive of the bracket 2, the shaft 3 and thrust plate 4 which are a fixed side member, Rota 5 which is rotation flank material, and Rota 5, and a shaft 3 and Rota 5, and between a thrust plate 4 and Rota 5.

[0019] A bracket 2 is the member of the shape of a circular ring which constitutes the base of the hydrodynamic bearing motor 1. The flange 22 is formed in the periphery part while the through tube 21 is formed in the central part.

[0020] A shaft 3 consists of metal, for example, stainless steel, and the slot 32 for dynamic pressure generating where the upper limit side was inner-******(ed) by the through tube 21 of a bracket 2 in the condition of having projected from the bracket 2 and which is a cylinder-like member and generates dynamic pressure between Rota 5 in the upper limit side peripheral face 31 is formed.

[0021] While a thrust plate 4 consists of metal, for example, stainless steel, it is joined by the upper limit side of a shaft 3 (it mentions later for details) and this constitutes the shaft section by the thrust plate 4 and the shaft 3, it is inserted in crevice 51a of Rota 5, and, on the other hand, the lower slot 411 for dynamic pressure generating which generates dynamic pressure between Rota 5 in a field 41 periphery side is formed.
[0022] Rota 5 has the cylindrical section 51 which equipped the central part with the circular fitting hole by which outside attachment immobilization is carried out at the upper limit side of a shaft 3, and the flange 52 installed from the cylindrical section 51 by the method of the outside of the direction of a path. the radial fluid dynamic pressure bearing HB one 1 constitutes the peripheral face of a shaft 3, the inner skin of Rota 5, and in between, and the thrust fluid dynamic pressure bearing HB one 2 constitutes between the inferior surface of tongue of a thrust plate 4, and the crevice 51a base of Rota 5 -- having -- **** -- the radial fluid dynamic pressure bearing HB one 1 and the thrust fluid dynamic pressure bearing HB one 2 -- minding -- Rota 5 -- a shaft 3 and a thrust plate 4 -- receiving -- relativity -- it is supported pivotable.
[0023] the cylindrical section 51 -- the path of the central hole of magnetic-disk D -- abbreviation -- it has an equal path dimension, and where magnetic-disk D is laid on a flange 52, it fits in. The cylinder-like Rota magnet 6 with which it comes to be reversed of a magnetic pole in a predetermined pitch is attached in the hoop direction at the flange 52. A stator 7 is equipped with the stator core 71 constituted by carrying out the laminating of the core plate, and the coil 72 wound by two or more places of the hoop direction of this stator core 71, and a stator core 71 is fixed to the flange 22 of a bracket 2. Covering 8 covers crevice 51a of Rota, and prevents exsorption of the lubricating oil from crevice 51a.
[0024] Next, the radial fluid dynamic pressure bearing HB one 1 and the thrust fluid dynamic pressure bearing HB one 2 are explained using drawing 2 and drawing 3 . Drawing 2 is the development view of the peripheral face 31 for explaining the dynamic pressure generating slot formed in the shaft 3, and drawing 3 is a top view for explaining the dynamic pressure generating slot formed in the thrust plate 4.
[0025] As shown in drawing 2 , it passes, and the radial fluid dynamic pressure bearing HB one 1 is equipped with the ring bone-like slot 311, the shaft 3, and the lubricating oil with which the gap between Rota 5 (width of face of several micrometers) was filled up whose depth is several micrometers, and consists of shape of a character of "**" formed in the peripheral face 31 of a shaft 3. At the time of rotation of a shaft 3, it passes and fluid pressure becomes the highest by flection 311a of the ring bone-like slot 311, by this part, the dynamic pressure in a radial direction occurs and the radial fluid dynamic pressure bearing HB ones 1 functions as bearing. In addition, instead of passing and forming the ring bone-like slot 311 in the peripheral face 31 of a shaft 3, you may make it form in the inner skin of Rota 5, and may make it form in both sides, and the same effectiveness is acquired.
[0026] As shown in drawing 3 , the depth is equipped with the ring bone-like slot 411 and the lubricating oil of a thrust plate 4 with which the gap between a field 41 and the crevice 51a base of Rota 5 (width of face of several micrometers) was filled up on the other hand to that [several micrometers], and the thrust fluid dynamic pressure bearing HB one 2 consists of shape of a character of "**" of a thrust plate 4 formed in the field 41 periphery side on the other hand. At the time of rotation of a shaft 3, it passes and fluid pressure becomes the highest by flection 411a of the ring bone-like slot 411, by this part, dynamic pressure occurs in the thrust direction and the thrust fluid dynamic pressure bearing HB one 2 functions as bearing. In addition, it passes, and instead of [of a thrust plate 4] on the other hand forming in a field 41, you may make it form the ring bone-like slot 411 in the crevice 51a base of Rota 5, and may make it form it in both sides, and the same effectiveness is acquired.
[0027] The shaft 3 relevant to both [these] the dynamic pressure bearings HB1 and HB2, a thrust plate 4, and the components dimension of Rota 5 are dozens of mm. From those members 3-5, in order to pass and to set up a gap with a width of face [of the ring bone-like slot 311,411 or bearing] of several micrometers, it must attach only not only in the process tolerance of those members, the stress at the time etc. must be taken into consideration, and the manufacturing technology high for securing a desired precision whose depth is several

micrometers is required.
[0028] Junction to a shaft 3 and a thrust plate 4 is performed by the resistance welding method using the junction equipment 10 shown in drawing 4 . Junction equipment 10 possesses a power source 11, the electrodes 12 and 13 of a vertical pair connected to the power source 11, the current control section 14 which performs energization control to a power source 11, and the energization device 15 which energizes the top electrode 12 to the bottom electrode 13 side, as shown in drawing 4 . A resistance welding method is the approach of performing by applying a pressure, heating a current with a sink and its Joule's heat into the part which it is going to weld.

[0029] Drawing 5 is an enlarged drawing a shaft 3 and near [each] the plane of composition of a thrust plate 4. In addition, the direction 41 of thrust plate 4 top Norikazu is called plane of composition 41 by the following explanation.
[0030] As shown in drawing 5 , the annular concave 33 is formed a little in the location by the side of a periphery at the shaft 3 from the center of abbreviation with the direction of path predetermined location in the plane of composition 32, for example, an axial center location, and a periphery edge. Moreover, it passes and the ring bone-like slot 311 is formed, and in order to raise whenever [curved-surface], the grinding process is performed to the peripheral face 31. On the other hand, in order [the] to pass to a field (the same field as a plane of composition 441) on the other hand, to form the ring bone-like slot 411 and to raise flatness, the grinding process is performed to the thrust plate 5. In addition, also when [of the peripheral face 31 of a shaft 3, or a thrust plate 5] it passes to a field 41 on the other hand and the ring bone-like slot 311,411 is not formed, a front face needs highly precise processing.
[0031] Drawing 6 shows the mixture 20 made to mix to the paste 22 which consists of insulating ingredients, such as grease, for the minute metal ball 21 as the diameter of the same being snug which consists of metal, for example, stainless steel. [much] In addition, although the minute metal ball 21 was mixed in the paste 22 in order to stabilize and hold the minute metal ball 21 on the plane of composition 32 of a shaft 3 before melting, this paste 22 is not indispensable. Moreover, carrying out melting of a shaft 3, a thrust plate 4, and the minute metal ball 21 makes the quality of the material of the minute metal ball 21 the same quality of the material (this operation gestalt stainless steel) as a shaft 3 and a thrust plate 4, and it is for increasing the junction force of a shaft 3 and a thrust plate 4 while advancing melting more efficiently. When the quality of the materials of a shaft 3 and a thrust plate 4 differ, it is good to make the quality of the material of the minute metal ball 21 the same as that of the quality of the material of one of members.
[0032] Next, mixture 20 is applied to the plane of composition by the side of the inner circumference of the annular concave 33 (henceforth inner circumference side plane-of-composition 32a) among the planes of composition 32 of a shaft 3, and a thrust plate 4 and a shaft 3 are put in order and set to a serial between an electrode 12 and 13. At this time, it is set using the fixture which is not illustrated so that those planes of composition 41 and 32 may serve as abbreviation parallel so that a core with a thrust plate 4 and a shaft 3 may agree.
[0033] Drawing 7 is drawing showing transition of the melting condition of a part in contact with the minute metal ball 21 and it at the time of energization.
[0034] Energization of the pulse current of a between [an electrode 12 and 13] is started making each planes of composition 32 and 41 of a shaft 3 and a thrust plate 4 counter, and energizing a pressure to planes of composition 32 and 41 according to the energization device 15, as shown in drawing 7 (a). As shown in (b), while the minute metal ball 21 and the part which contacts the minute metal ball 21 among a thrust plate 4 and a shaft 3 fuse by this, as shown in (c), with approach of the planes of composition 32 and 41 by melting of the minute metal ball 21, melt and a paste 22 are spread in a periphery side (the direction of an arrow head A), and flow into the annular concave 33 (the slash shows the inflow). In addition to the energization force of the energization device 15, a thrust plate 4 and the shaft 3 of each other can be drawn near by the metallic bond of melt as melting advances.
[0035] Although the electric resistance of this part becomes small when a touch area with the part in contact with the minute metal ball 21 and this minute metal ball 21 increases in

connection with melting of the minute metal ball 21 in that case, suitable welding can be performed by adjusting the amount of energization, and the resistance welding time by the current control section 14.
[0036] And after ending energization, melt is solidified soon, but as shown in (d), before melt solidifies, periphery side plane-of-composition 32b of a shaft 3 and the plane of composition 41 of a thrust plate 4 contact (adhesion). Above, junction to a shaft 3 and a thrust plate 4 is completed. In addition, a paste 22 is good to wash away and remove after welding termination, and when what is evaporated with heat as an ingredient of a paste 22 is used, you may make it an absorption means and a suction means remove the gas.
[0037] Thus, since do not form the lobe acting as [performing highly precise processing] a failure in the planes of composition 32 and 41 before junction, but the minute metal ball 21 is made to intervene between a plane of composition 32 and 41 and it was made to weld While there is no difficulty of processing for dynamic pressure slot formation or the grinding process for the improvement in flatness of a plane of composition and being able to make those fields very highly precise, the dynamic pressure slot formed in a thrust plate 4 can also make it very highly precise. Moreover, it sets like a series of welding operators, and since there is no process which damages a shaft 3 and the dynamic pressure slot 311,411 of a thrust plate 4, both the members 3 and 4 are joinable with the components condition before junction. Furthermore, the annular concave 33 is formed in a shaft 3, a weld zone is formed at the inner circumference side of this concave 33, and since the diffused melt was constituted so that it might be made to flow into this concave 33 and melt might not flow out between the planes of composition 41 of periphery side plane-of-composition 32b of a shaft 3, and a thrust plate 4, the contact to periphery side plane-of-composition 32b and a plane of composition 41 is not checked by melt. A shaft 3 and a thrust plate 4 are joinable, securing the squareness of a shaft 3 and a thrust plate 4 with high degree of accuracy by the above without using a special fixture.
[0038] Moreover, since the sludge which is the melt of the oxide film of each planes of composition 32 and 41 by positioning a weld zone in the center of abbreviation of planes of composition 32 and 41 is spread first of all as mentioned above, it flows into the annular concave 33 and a sludge does not remain in a weld zone, junction becomes certain.
[0039] Moreover, since the minute metal ball 21 was made to intervene between plane-of-composition 32b and 41, the flowing current density can become high and melting of the contact part can be carried out efficiently.
[0040] Moreover, the junction force can be increased because melting advances more efficiently and each part material fuses it, since said corpuscle was made into the same quality of the material (the 1st operation gestalt stainless steel) as said thrust plate 4 and shaft 3.
[0041] In addition, in the 1st operation gestalt, although the corpuscle was formed in the solid sphere, a corpuscle is not limited to a solid sphere, for example, the main purpose of this invention can attain a cube etc. in other configurations.
[0042] Moreover, although mixture 20 was applied to the shaft 3 side, you may make it apply mixture 20 to a thrust plate 4 side or both sides in the 1st operation gestalt.
[0043] Moreover, as a metal ball is shown in drawing 8 as 2nd operation gestalt of the technique held on the plane of composition 32 of a shaft 3 To the plane of composition 32 of a shaft 3, metal ball 21' with the above-mentioned annular concave 33 at least a part from this plane of composition 32 After most has projected preferably, for example, it holds, the conic crevice 34 is formed by cutting and you may make it join a shaft 3 and a thrust plate 4 in the condition of having made metal ball 21' holding to this crevice 34. Since it can join without forming a lobe which serves as a failure in each plane of composition 32 and 41 before junction performing highly precise processing while being able to stabilize and hold metal ball 21' on the plane of composition 32 of a shaft 3 before melting also by this, the same effectiveness as the 1st operation gestalt is acquired.
[0044] Moreover, the corpuscle made to hold to a crevice may have other configurations, such as not only a spherical thing but a cube configuration.
[0045] Although the thrust plate 4 was set to the movable electrode 12 and the shaft 3 was set to the fixed electrode 13, it is made contrary (a thrust plate 4 is set to a fixed electrode 13, and

a shaft 3 is set to a movable electrode 12) to it as 3rd operation gestalt, and you may make it join with the 1st and 2nd operation gestalt.
[0046] Namely, although the annular concave 33 is formed in the plane of composition 32 of a shaft 3, mixture 20 is applied to the inner circumference side plane-of-composition 32a etc. and both the members 3 and 4 were joined by resistance welding with the 1st operation gestalt As shown in drawing 9 , while forming the annular concave 412 as a melt receptacle slot on the minor diameter in the plane of composition 41 of a thrust plate 4 from the outer diameter of a shaft 3 Mixture 20 is applied to the inner circumference side plane-of-composition 41a etc., a thrust plate 4 is set to a fixed electrode 13, a shaft 3 is set to a movable electrode 12, and you may make it join both the members 3 and 4 by resistance welding.
[0047] Moreover, although the shaft 3 and the thrust plate 4 were joined by resistance welding in the condition of having established the annular concave 33 and the crevice 34 holding the metal ball 21 in the plane of composition 32 of a shaft 3 with the 2nd operation gestalt, and having made the metal ball 21 holding to the crevice 34 As shown in drawing 10 , while forming the annular concave 413 as a melt receptacle slot on the minor diameter, and the crevice 414 holding the metal ball 21 in the plane of composition 41 of a thrust plate 4 from the outer diameter of a shaft 3 as 4th operation gestalt Mixture 20 is applied to the inner circumference side plane-of-composition 41a' etc., a thrust plate 4 is set to a fixed electrode 13, a shaft 3 is set to a movable electrode 12, and you may make it join both the members 3 and 4 by resistance welding.
[0048] Moreover, although the slot 33,412,413 as a melt receptacle slot is established in the plane of composition of the member arranged with the down side at the time of welding, you may make it prepare in the plane of composition of the member arranged at the bottom in each above-mentioned operation gestalt.
[0049] Next, the junction approach concerning the 5th operation gestalt of this invention is explained.
[0050] The junction approach concerning this operation gestalt is that to which the point of securing squareness by forming each planes of composition 32 and 41 of a shaft 3 and a thrust plate 4 in a concave configuration without using a metal ball is different from the 1st - the 4th operation gestalt. Since it is the same as that of abbreviation about the point welded by the resistance welding method using junction equipment 10, the above-mentioned difference is mainly explained and explanation is omitted about the other point. in addition, the 1- the same number is attached about the same member as the 4th operation gestalt.
[0051] As shown in drawing 11 , the crevice 35 of the shape of a circular ring as a crevice for melt receptacles is formed in the plane of composition 32 of a shaft 3 so that an axial center may be surrounded, and inner circumference side plane-of-composition 32c is formed in it (the annular crevice 35 and inner circumference side plane-of-composition 32c are equivalent to the central field section). It passes to the peripheral face 31 of a shaft 3, and the ring bone-like slot 311 is formed in coincidence.
[0052] On the other hand, in the plane of composition 41 of a thrust plate 4, the circular sulcus 415 which has the outer-diameter dimension of a major diameter from a shaft 3 is formed in the plane of composition by the side of a periphery (henceforth 32d of periphery side planes of composition) by cutting from the crevice 35 of a shaft 4. In that case, while forming a taper in a crevice 35, the inner circumference edge of a circular sulcus 415, and a periphery edge, respectively, a crevice 35 comes to have the outer-diameter dimension of a major diameter from the bore of the circular sulcus 415 of a thrust plate 4. Furthermore, it passes to the periphery side of a plane of composition 41, and the ring bone-like slot 411 is formed.
[0053] And energization of the pulse current of a between [an electrode 12 and 13] is started, making inner circumference side plane-of-composition 32c of a shaft 3 and a thrust plate 4, and 41a" contact, and energizing a pressure to planes of composition 32 and 41 according to the energization device 15, as a thrust plate 4 and a shaft 3 are put in order and set to a serial between an electrode 12 and 13 and it is shown in drawing 12 . At this time, it is set using the fixture which is not illustrated so that planes of composition 32 and 41 may serve as abbreviation parallel so that a core with a thrust plate 4 and a shaft 3 may agree.

[0054] While the part where a thrust plate 4 and a shaft 3 contact fuses by this, both members of each other can be drawn near by the metallic bond of this melt, and melt is spread toward periphery side taper side 35a of a shaft 3 with approach of planes of composition 32 and 41, and it flows into a crevice 35.
[0055] And as shown in drawing 13 , after ending energization, melt is solidified soon, but before melt solidifies, 32d of periphery side planes of composition of a shaft 3 and base 415a of the circular sulcus 43 of a thrust plate 4 contact (adhesion). Above, junction to a shaft 3 and a thrust plate 4 is completed. At this time, melt is solidified in the condition of having collected on periphery side taper side 35a of a shaft 3.
[0056] Thus, since there is no lobe acting as a failure in performing highly precise processing to the planes of composition 32 and 41 before junction and the contact to 32d of periphery side planes of composition and a plane of composition 41 is not checked by melt, also in this operation gestalt, the same effectiveness as the 1st – the 4th operation gestalt is acquired.
[0057] In addition, the shape of a quirk for melt receptacles formed in the plane of composition 32 of a shaft 3 will not be restricted in the shape of a circular ring, if annular.
[0058] Moreover, instead of forming the circular sulcus for melt receptacles, it has taper side 36a at a periphery edge, and you may make it form the crevice 36 shallower than the circular sulcus 415 of a thrust plate 4 in it by cutting, as shown in drawing 14 . In this case, the pulse current of a between [an electrode 12 and 13] is energized, putting in order and setting a thrust plate 4 and a shaft 3 to a serial between an electrode 12 and 13, making base 36a of a crevice 36, and plane-of-composition 41a″ of a thrust plate 4 contact, and energizing a pressure to planes of composition 32 and 41 according to the energization device 15, as shown in drawing 15 , and melting of the part where a thrust plate 4 and a shaft 3 contact is carried out. At this time, melt is spread toward taper side 36a of a shaft 3 with approach of the planes of composition 32 and 41 by this melting, and melt collects on taper side 36a of a shaft 3.
[0059] And as shown in drawing 16 , before it ends energization and melt solidifies, 32d of periphery side planes of composition of a shaft 3 is made to contact base 415a of the circular sulcus 415 of a thrust plate 4 (adhesion).
[0060] The same effectiveness as the above-mentioned operation gestalt is acquired by this.
[0061] In addition, although it has the configuration to which the shaft section was fixed if it is in the hydrodynamic bearing motor of each above-mentioned operation gestalt, this invention is applicable similarly about the hydrodynamic bearing motor by which the shaft section was constituted as a part of body of revolution. Moreover, a hydrodynamic bearing motor may be used considering air as lubricant in addition to the above-mentioned lubricating oil.
[0062]
[Effect of the Invention] [whether in order to perform highly precise processing to the plane of composition before junction, do not form a lobe which serves as a failure, but a corpuscle is made to intervene between planes of composition, and it is made to weld according to this invention, and] Or a lobe which serves as a failure in order to perform highly precise processing to the plane of composition before junction is not formed. Since the central field section including this crevice of the crevice for melt receptacles which has a major diameter is formed in the end face of a shaft and this central field section and the center section of the one direction of a plate were joined to it from the bore of the circular sulcus of a plate While there is no difficulty of processing for dynamic pressure slot formation or the grinding process for the improvement in flatness of a plane of composition and being able to finish a plane of composition very with high precision By existence of a melt receptacle slot, do not reach the outer-diameter side of the melt fang furrow by the side of the bore of a slot, and without melt intervening, as for each plane of composition by the side of the outer diameter of a slot, will contact and it sets like a series of welding operators. Since it does not act, it can have highly precise dynamic pressure bearing, and, as for stress which checks the squareness of dynamic pressure bearing constituted with a shaft and a plate, squareness can obtain the good shaft section.
[0063] Moreover, since said corpuscle was made into the granular solid sphere, the flowing current density can become high and melting of the contact part can be carried out efficiently.
[0064] Moreover, since said corpuscle is mixed to the flow paste which has insulation and this

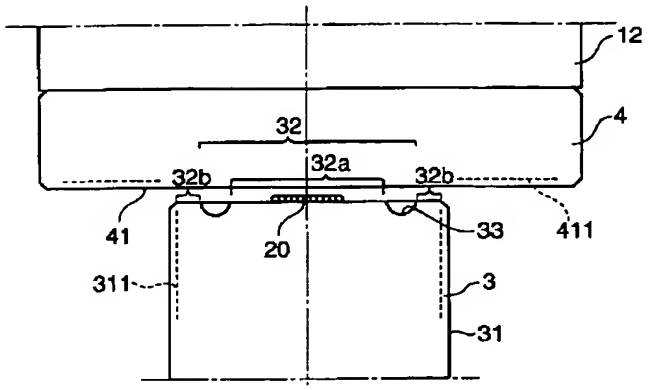
mixture was applied to the part corresponding to said bore side in the field of the bore side of said melt receptacle slot, or another side, on the end face of a shaft, it is stabilized and a corpuscle can be held.

[0065] Moreover, since the crevice which carries out location immobilization of said corpuscle where a part is projected from the field of a member where this melt receptacle slot was formed in the bore side of said melt receptacle slot was prepared, on the end face of a shaft, it is stabilized and a corpuscle can be held.

[0066] Moreover, since said corpuscle was made into the same quality of the material as either said plate or said shaft at least, while being able to advance melting more efficiently, the junction force can be increased because each part material fuses.

[Translation done.]

Drawing selection Representative drawing



[Translation done.]